PATH

Planning & Analysis in Timber Harvesting

Spreadsheet Utility & Instruction Manual

Developed by **STEVEN BICK**

Published by **Northeastern Loggers' Association & The Forest Enterprise Institute, Ltd.**

Northeastern Loggers' Association, Inc.

WERC
Wood Education and Resource Center

Planning & Analysis in Timber Harvesting: A User Manual

Steven Bick

A Northeastern Loggers' Association

and

Forest Enterprise Institute Publication

Planning & Analysis in Timber Harvesting: A User Manual
Published in the United States of America
by the Northeastern Loggers' Association
Old Forge, NY

and

The Forest Enterprise Institute, Ltd.
Thendara, NY

PATH

ISBN 978-0-9794401-5-1
0-9794401-5-7

About PATH

PATH was created by Steven Bick of Northeast Forests, LLC

1. The work upon which this publication/CD/DVD/software is based was funded in whole or in part through a grant awarded by the Wood Education and Resource Center, Northeastern Area State and Private Forestry, Forest Service, U.S. Department of Agriculture

2. The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Disclaimer

PATH and the accompanying user manual were developed for informational purposes. The author and distributors do not guarantee the accuracy of the formulas used, nor are they responsible for any errors or omissions contained herein. You are advised to consult a financial advisor before using these materials as the basis for any business investment or operations decisions.

.

`

Cover Design by Mandy-Scott Bachelier

Mandy-Scott Bachelier is the Art Director for PERC (the Property and Environment Research Center) in Bozeman, MT. Her tasteful design approach for clients such as The World Bank, the Hoover Institution, and of course PERC, always entails a unique yet collaborative vision of the client's message with her own sensibilities. She can be reached at mandyscott@perc.org.

Contents

Getting Started 5

PATH Macros and Security 6

Path Home Page 8

General Navigation in PATH 9

General Production Analysis Worksheet 10

Analysis of General Production Results 12

Analysis Report 13

Equipment Options 14

Comparing Multiple Equipment Arrays 16

Equipment Summary 17

Trucking Options 18

Comparing Multiple Trucking Arrays 20

Trucking Summary 21

Analyzing Equipment Alternatives 22

Estimating Individual Job Cost 25

Price and Production Calculations & Comparisons 31

Amortization Utility 33

Suggested Rates 34

Combining Production of Multiple Products 35

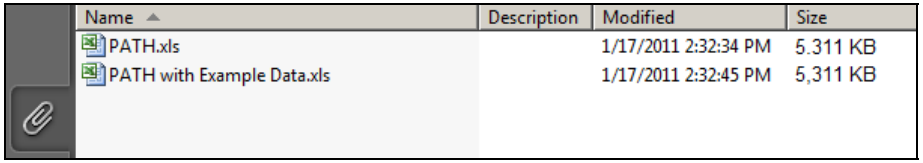
List of Formulas by Worksheet 39

Getting Started

PATH is a highly formatted Microsoft Excel Spreadsheet. It contains many worksheets, linked together and formatted for convenient navigation. You are probably reading this user manual in Adobe Acrobat Reader. Two copies of PATH are built into the electronic version of this manual and can be accessed at any time through Acrobat.

To see the copies of PATH included in this manual, look for a symbol on the lower left that looks like this:

Clicking on this symbol reveals the attached files in the lower section of the window:



The first version is blank to allow you to enter your own data. The second version has example data in it, in case this helps you visualize how PATH works.

PATH is free and you may distribute it to anyone you like. The best way to do this is to give the recipient a copy of this user manual and they will get PATH as an attachment to it.

Double-click on either of the files to open them. You must have a copy of Microsoft Excel on the computer for the file to open and be useable. You may get a prompt about Macros (see the following section, PATH Macros and Security, for more details).

Once you have opened PATH, you should save a copy of it to your hard drive. It a good idea to create a folder called "PATH" and save the file there. As you use PATH over time, you may find yourself wanting to save various versions of the file with different names (e.g. PATH for general calculations.xls, PATH with new trucking options.xls, etc.)

If you have saved PATH to your hard drive, you will not need to access it through the copies embedded in the manual in the future.

PATH is a very large spreadsheet, with 12 different worksheets. Many of these worksheets are similar in appearance and it can be easy to get lost within them when you first start using PATH. There are a couple of suggestions to help you with navigation.

The PATH logo appears in the upper left-hand side of each worksheet and in many other locations within sheets. Clicking on this logo will return you to the home page/index. A list of links to each of the worksheets is included on the left-hand side of each sheet.

Several of the worksheets are so large that you cannot view the entire work area on the screen. This may lead you into locations that could be confusing. If you find yourself lost within a sheet, pressing the Ctrl and Home keys at the same time will bring you to the upper left hand side (starting point) for each worksheet.

Using PATH will be easier if you adjust the zoom level in Excel to a setting you are comfortable with. The zoom level is adjusted by going to the *View* menu and selecting *Zoom*. This allows you to select a zoom level as a percentage of the actual size of the page. Depending on how you screen resolution is set, zoom levels in the 75 to 125% seem to work well.

PATH Macros and Security

There are several Macros present in PATH. All of these Macros are safe – they will not damage your computer! PATH Macros are used to make printing reports easier, to make sure the file opens in the same place each time and to automate tedious duplication of data entry.

Some people use Macros to sabotage computers with viruses, so Microsoft Excel has several security settings to protect and warn you.

Microsoft Excel will do one of three things when you open PATH, depending on your Macro protection settings:

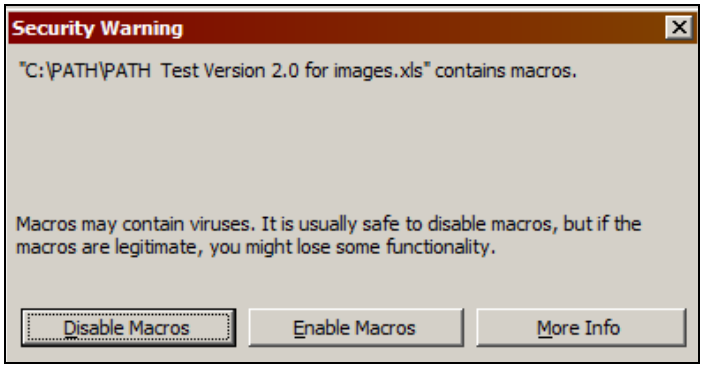
1. Simply open the file (low setting);

2. Warn you that Macros are present and ask if you want to enable them by clicking on the Enable Macros button (medium setting);

3. The files will open and the Macros will be disabled. A message will tell you to lower the security setting if you want to run them (high setting); or

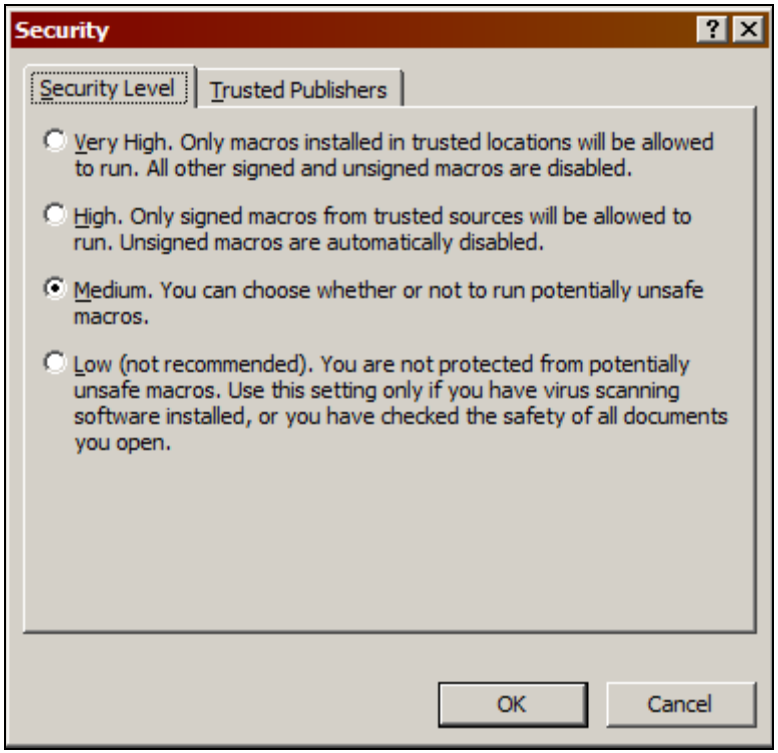
4. The file will open and the Macros will be disabled with no message about them (very high setting)

Allowing the Macros to run will make using PATH easier. Using the Medium Level of Macro Security is a reasonable safeguard, as it will give you the following prompt each time a file that contains Macros is opened:


Security Warning
"C:\PATH\PATH Test Version 2.0 for images.xls" contains macros.
Macros may contain viruses. It is usually safe to disable macros, but if the macros are legitimate, you might lose some functionality.
Disable Macros
Enable Macros
More Info

Click on the "Enable Macros" button to allow the Macros to run.

To place Excel in the Medium Level Security setting, go to the Tools menu, then Options. Click on the Security Tab and then the Macro Security button Click on the Medium setting as shown here:


Security
Security Level
Trusted Publishers
Very High. Only macros installed in trusted locations will be allowed to run. All other signed and unsigned macros are disabled.
High. Only signed macros from trusted sources will be allowed to run. Unsigned macros are automatically disabled.
Medium. You can choose whether or not to run potentially unsafe macros.
Low (not recommended). You are not protected from potentially unsafe macros. Use this setting only if you have virus scanning software installed, or you have checked the safety of all documents you open.
OK
Cancel

Click on the Medium setting on the Security Level tab and then click the OK button.

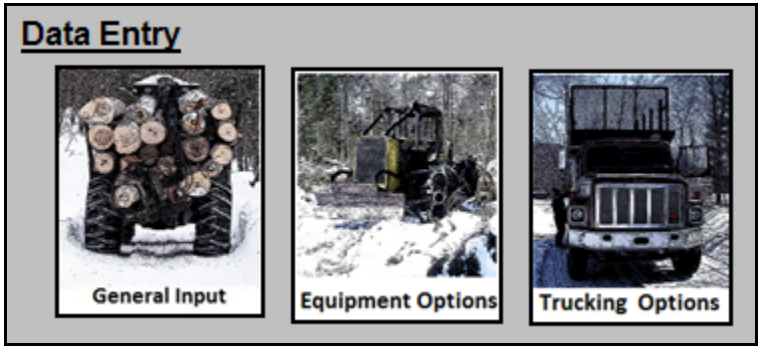
PATH Home Page

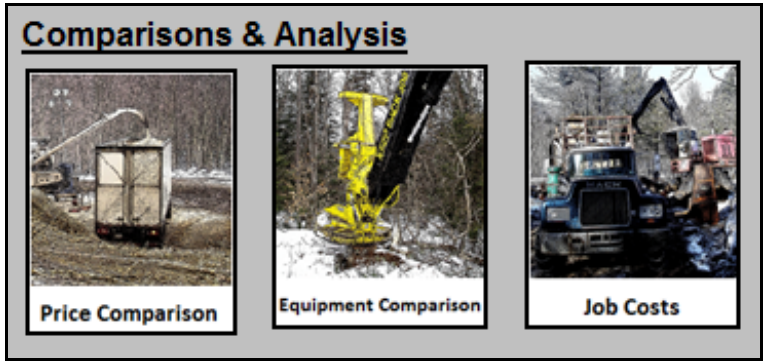
PATH automatically opens to the home page/index each time you open it. This worksheet serves as a link to all of the others.

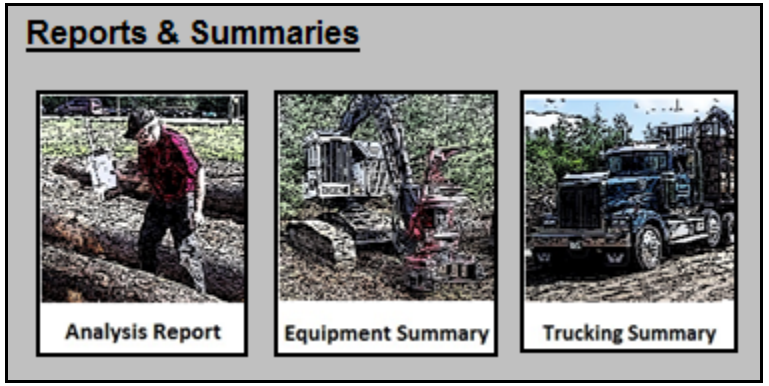
The top of this page has a link called *Advice for Using PATH*. Follow this link for a short list of useful pointers for using PATH.

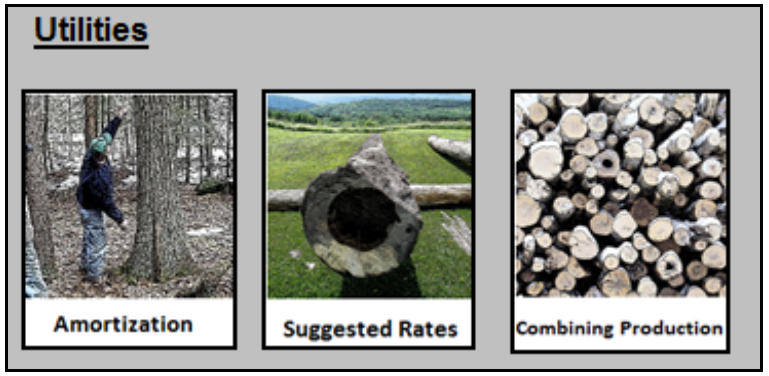
Worksheets and important locations within them can be reached by clicking on one of the twelve photo icons in this page.

<u>These links are organized as follows:</u>









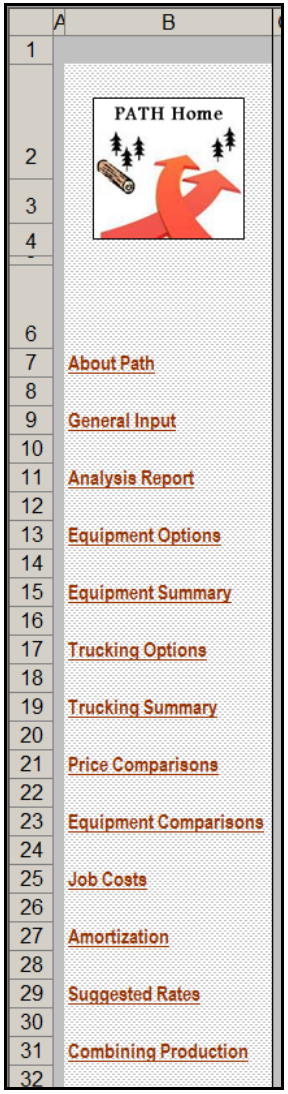
General Navigation in PATH

Each of the worksheets in PATH includes a navigation bar (shown here on the right). PATH has been formatted so that this navigation bar will always be visible on the left hand side of your screen.

Clicking on the PATH Home icon (shown below) will always bring you back to the Home Page/Index.

Below the PATH Home icon are links to the various worksheets and important locations within them.

Upon first using PATH, it is easy to become disoriented about your location. Clicking the PATH Home icon is a good way to return to the familiar index, or clicking on one of the links will bring you to the specified location you are looking for.



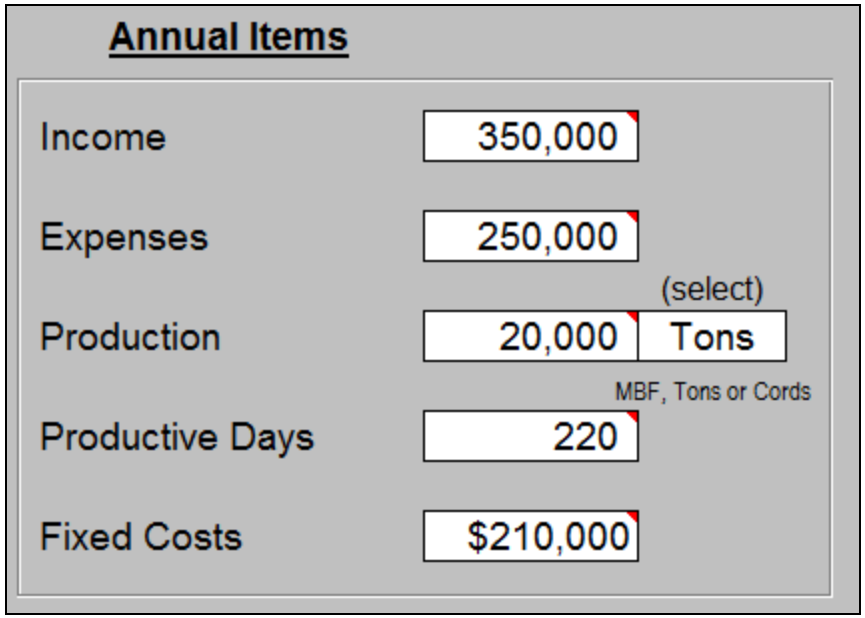
PATH Navigation Bar

General Production Analysis Worksheet

The General Production Analysis Worksheet (tab name General Input) provides a quick way for you to analyze your existing business and explore a few "what if?" scenarios. Initially you are asked to provide your income, expenses, annual production (in MBF, tons or cords). A convenient table on the right shows you where you can locate this information in your tax return. Two additional pieces of information are needed – your average number of productive working days and the percent of your costs that are fixed.

Productive days are those that your operation is set up on a job site harvesting timber and producing various products. While the total number of days a logger works is generally much higher, you must distinguish between time spent in support of your productive enterprise and those days when you are actually producing. Depending on the weather, the work available to you and the type of equipment you have, you operation probably falls somewhere in the broad range of 150 to 250 days annually. Later on in this worksheet, you will be able to vary the number of productive days to see how this impacts your revenue and production.

The fixed costs are probably the least certain piece of information used here as an input. If you guess at this number, bear in mind that your results are less certain. A careful analysis of the expenses you report on your income tax return can help you determine this. In general, fixed costs are anything that you have to pay regardless of if you produce (e.g. property taxes, liability insurance, utilities, mobile phone, bookkeeper, mechanic, etc.) while variable costs are those incurred in production (fuel, oil, equipment labor, etc.)



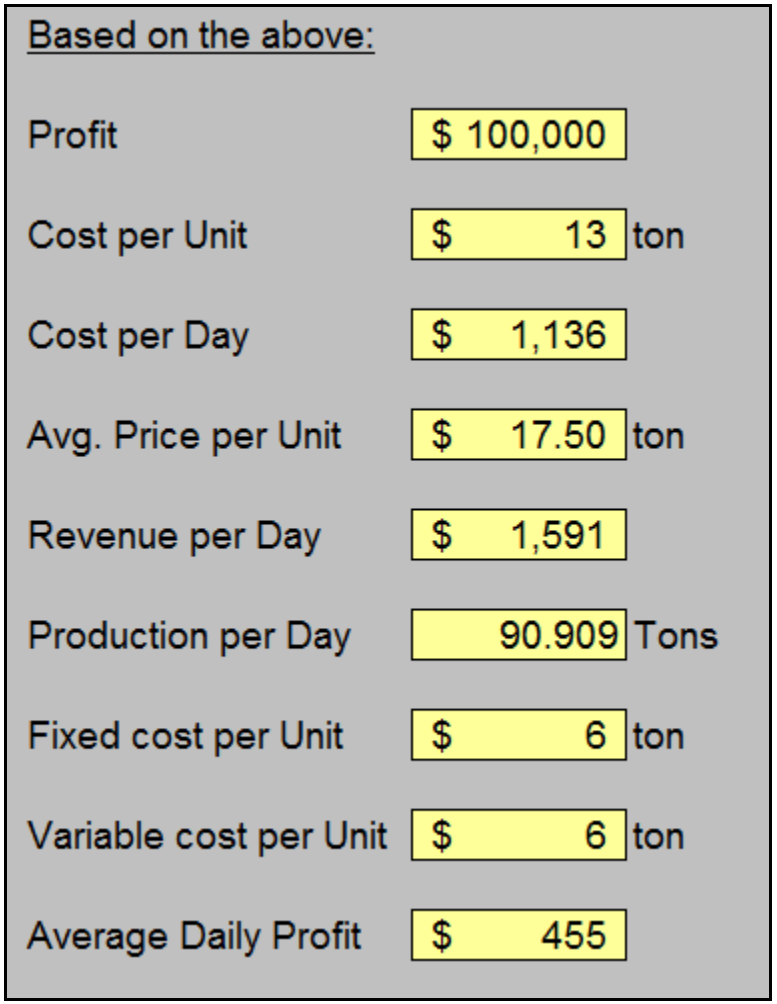
General Production Input Items

Income & Expenses Information Sources			
	IRS Form	Income	Expenses
Proprietorship	1040, Sch C	Line 7	Lines 28+30
C Corporation	1120	Line 11	Line 27
Partnership	1065	Line 8	Line 21
S Corporation	1120S	Line 6	Line 20

Sources of Income and Expense Information

Once the general information has been entered, you can scroll down to see a number of important calculations that have been made. The first of these is profit – no surprises here, expenses have simply been subtracted from income.

Calculations of daily costs, production and various costs per unit are made (a summary of these calculations are shown on the right).



General Production Analysis Calculations

Analysis of General Production Results

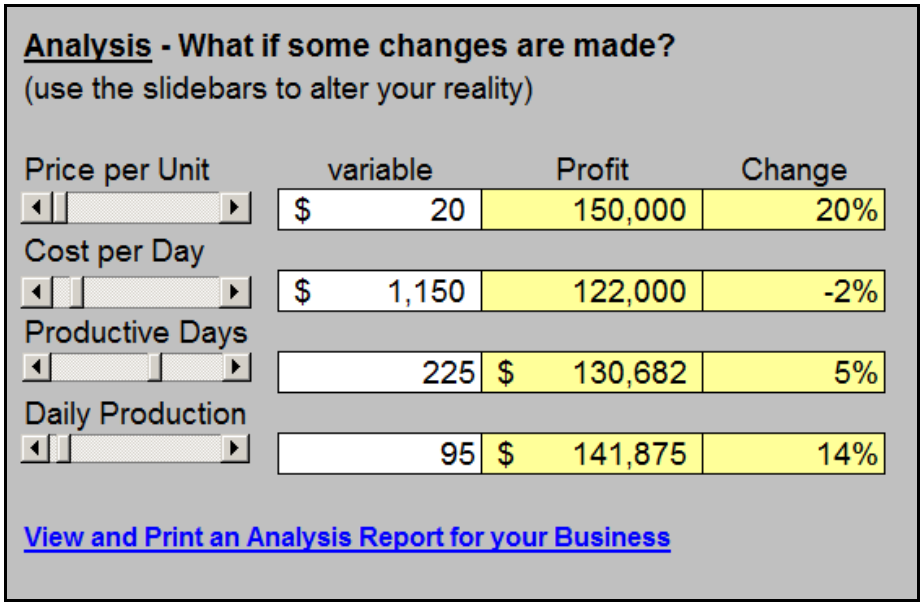
Once you have entered the initial general production information in PATH, you have the opportunity to alter some of the key variables and see how they impact profits. Convenient slide bars allow you to quickly view incremental changes.

The price per unit (MBF, tons or cords) can be altered to any number ranging from $1 to $2,000. Actual profit (or loss) based on this new price is shown, as well as the percent change.

The cost per productive day can be altered to any number ranging from $1 to $10,000. Actual profit (or loss) based on this new daily cost is shown, as well as the percent change.

The number of productive days can be altered from 1 to 365 (neither extreme being terribly realistic). Actual profit (or loss) based on this new number of productive days is shown, as well as the percent change.

Daily production (in MBF, tons or cords) can be altered from 1 to 2,000. Actual profit (or loss) based on this new daily production is shown, as well as the percent change.



Sensitivity Analysis of Key Production Variables

Analysis Report

A link in the General Production Analysis Worksheet reads "View and Print an Analysis Report for your Business". This link brings you to a fully formatted, printer friendly report. This report was created automatically using the general production inputs you supplied. Each report is stamped with the current data and time of printing.

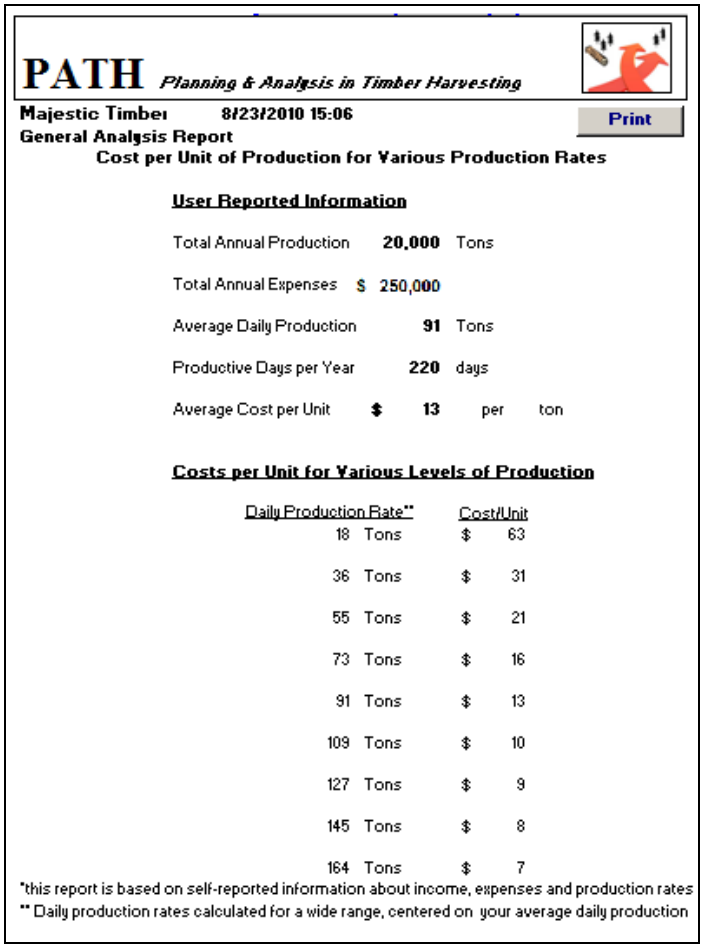
The user-supplied information and related calculations are summarized, including annual production, annual expenses, average daily production, productive days per year and the average cost per unit.

The cost per unit for a range of daily production is calculated and shown. This range is centered on the daily average and shows increments of 20-180% of it, in 20% increments.

The second page of the report asks and answers a series of questions about your business, each related to minor changes in production, prices and expenses.

The third page is a table showing the offsetting increase in production needed to keep profit constant in the face of price decreases.

The fourth page of the report is a table showing the offsetting increase in price and production needed to keep profit constant in the face of costs increases.



PATH *Planning & Analysis in Timber Harvesting*

Majestic Timber 8/23/2010 15:06 Print

General Analysis Report

Cost per Unit of Production for Various Production Rates

User Reported Information

Total Annual Production	20,000	Tons
Total Annual Expenses	$ 250,000	
Average Daily Production	91	Tons
Productive Days per Year	220	days
Average Cost per Unit	$ 13	per ton

Costs per Unit for Various Levels of Production

Daily Production Rate**	Cost/Unit
18 Tons	$ 63
36 Tons	$ 31
55 Tons	$ 21
73 Tons	$ 16
91 Tons	$ 13
109 Tons	$ 10
127 Tons	$ 9
145 Tons	$ 8
164 Tons	$ 7

*this report is based on self-reported information about income, expenses and production rates

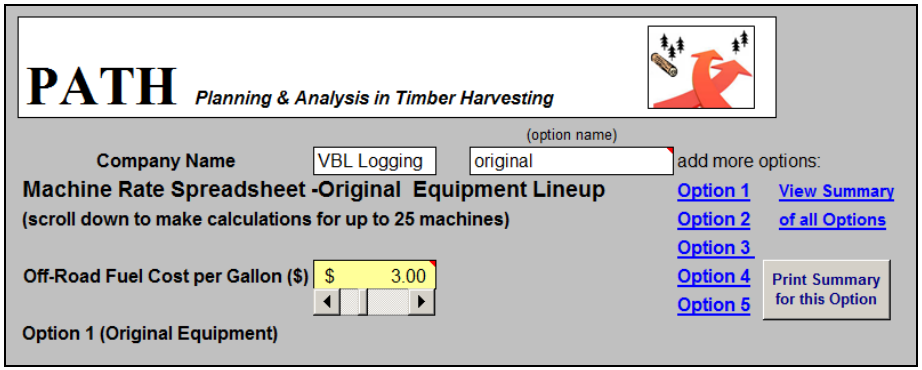
** Daily production rates calculated for a wide range, centered on your average daily production

Page One of the Analysis Report

Equipment Options

The Equipment Options worksheet (tab name Equipment) allows you to determine the hourly costs for each piece of your equipment (up to 25). It also allows you to compare alternative equipment arrays (up to 5). Results are summarized in a printer friendly report and this information is used in other worksheets for further analysis.

Upon entering the sheet, you are brought to the series of data entry boxes for your original equipment and prompted to name the option. A slide bar allows you to set and alter the fuel price for all of the machines at the same time.



Equipment Machine Rate Heading

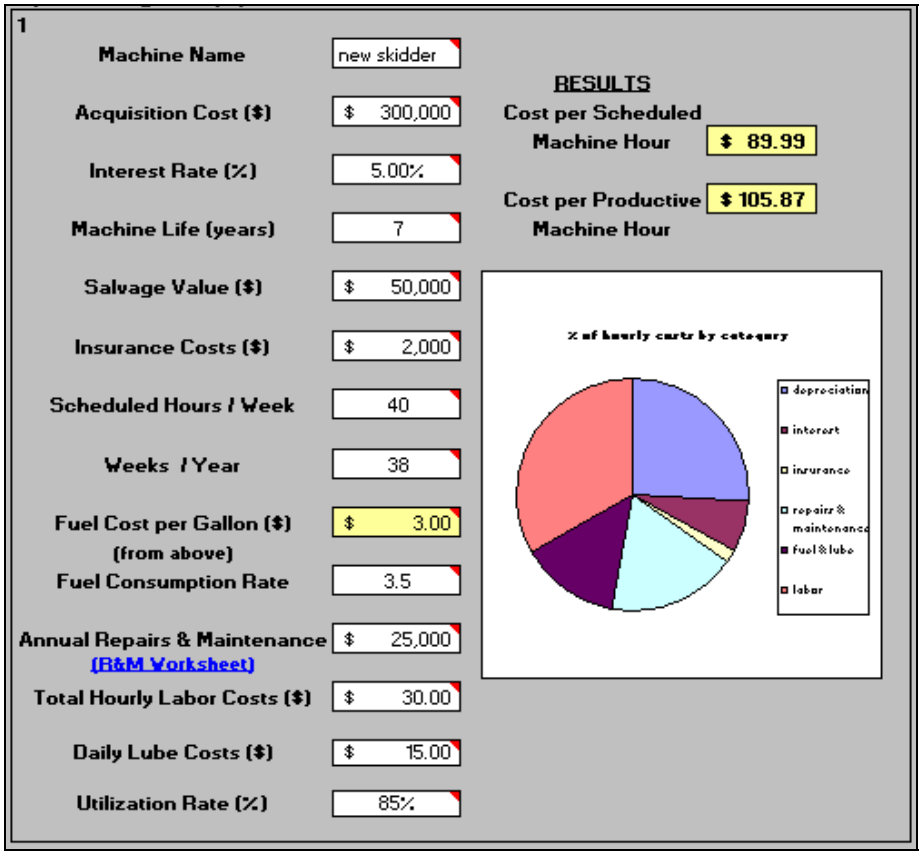
Each of the five equipment options has data entry sheets stacked atop one another in a series of columns. The option number (1, 2, 3, 4 or 5) runs continually down the length of the outside column.

Each machine is numbered and the user must supply a descriptive name. There are several white-cell inputs that must be filled in. Acquisition cost is the first of these. Interest rate comes next (or alternative rate of return for equipment purchased outright). Machine life (in years) and salvage value must be supplied as well, to allow PATH to calculate depreciation. Insurance is another of the fixed costs that must be entered.

The scheduled hours per week and number of weeks per year are used in determining hourly costs. Fuel costs are supplied for all machines at once at the top of the page, as mentioned earlier. Annual repairs and maintenance costs must be entered (a link takes you to a brief worksheet to help you calculate this). Hourly labor costs and the utilization rate (% of scheduled time the machine is actually in operation) complete the inputs.

With these inputs in place, the cost per scheduled machine hour and cost per productive machine hour are calculated. These figures, in turn, are used in calculations by other worksheets.

A small pie chart showing the hourly costs by category is supplied.



Individual Machine Rate Data Entry and Results

Individual machine rate information is summarized in a white table to the right of the data input area. This information is shown for informational purposes, but not intended to be printed or altered. All of the pertinent information from this table is summarized and used elsewhere.

Summary Information Used in Calculations
(DO NOT ALTER THIS AREA)

Name: Venture Logging

1,920.00 hours per year

annual cost	$/SMH	$/PMH	
13,666.67	$ 7.12	$ 8.09	depreciation
3,291.67	$ 1.71	$ 1.95	interest
2,000.00	$ 1.04	$ 1.18	insurance
8,200.00	$ 4.27	$ 4.85	repairs & maintenance
27,456.00	$ 14.30	$ 16.25	fuel & lube
72,960.00	$ 38.00	$ 43.18	labor
127,574.33	$ 66.44	$ 75.51	

fixed	variable	
21%	79%	fixed/variable cost ratio

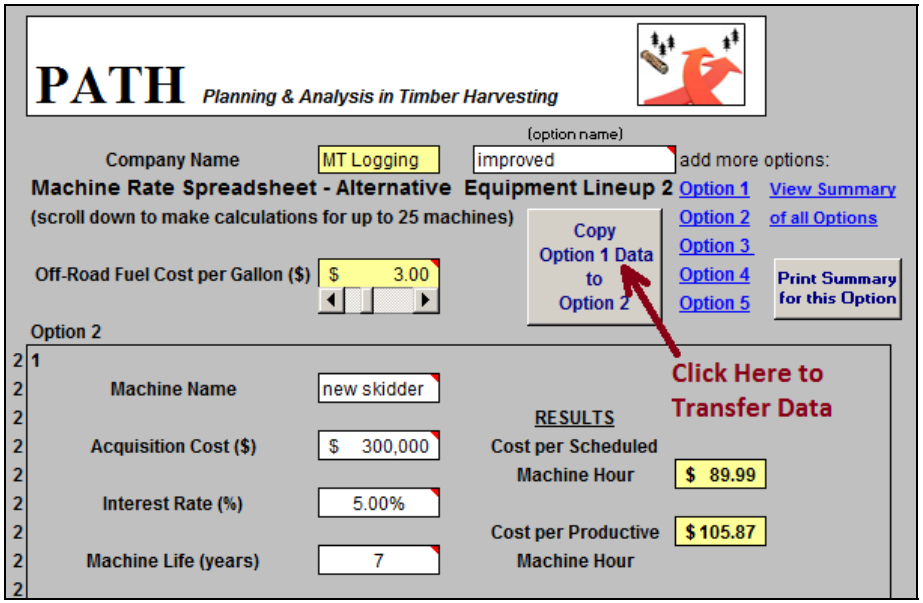
Machine Rate Summary Information

Comparing Multiple Equipment Arrays

In addition to calculating the costs of owning and operating individual pieces of equipment and your collection of equipment as a whole, PATH allows you to compare these costs to alternative collections of equipment you may be considering. Five different collections of up to 25 machines each can be compared (PATH has a similar feature for trucking comparisons).

Often the comparison you would like to make will involve slight alterations to your existing equipment. For example, you might be considering replacing three of your existing pieces of equipment with two new ones. To avoid entering the same data twice, PATH has a feature that allows you to copy all of the equipment data from one option into the next one. You will then have to remove data for the pieces of equipment you are considering replacing and add the data for the new equipment. You will also have to set the fuel cost for the new option.

The headings for Equipment Options two through five have a button that, when clicked, transfers all of the data from the previous option. Note that this cannot be easily undone. Undoing it can either be accomplished by exiting the file without saving your changes (something that in most cases will cause you to lose work that you might prefer to keep) or by manually deleting the data from each of the cells.



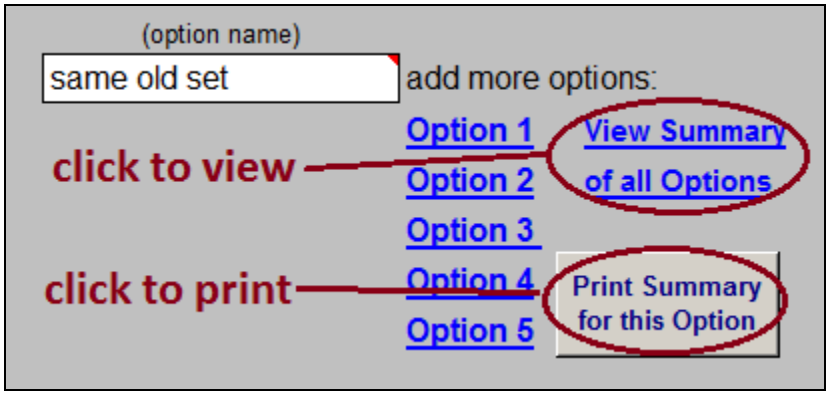
Data can be copied from one Equipment Option to Another

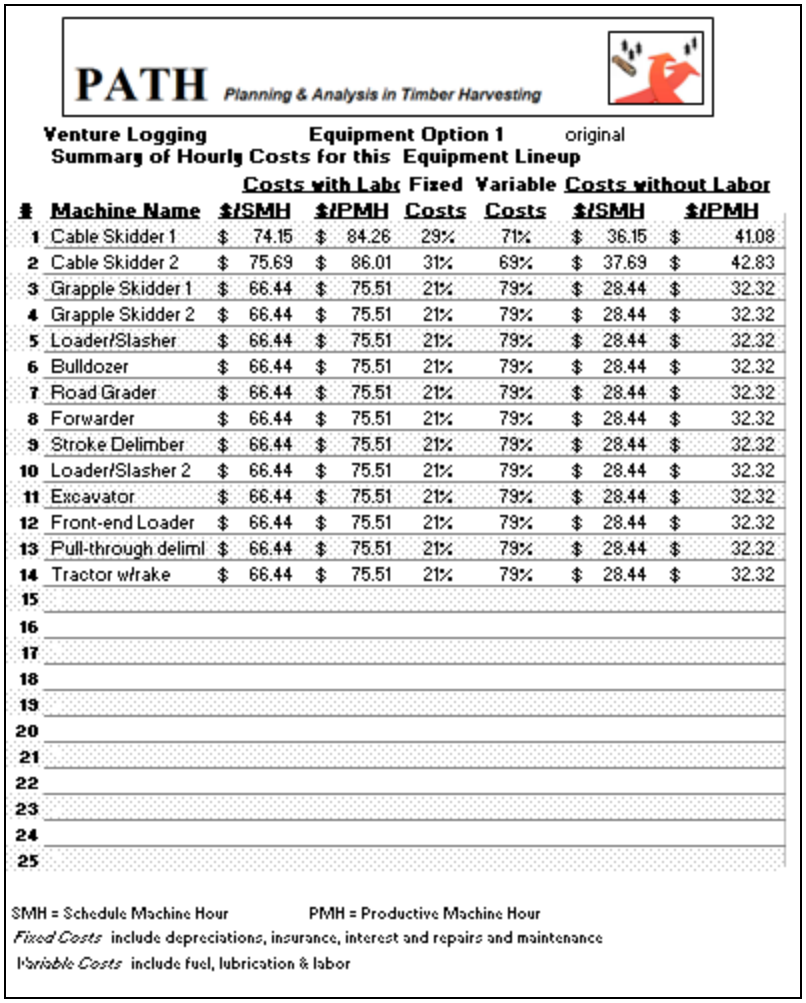
Equipment Summary

After you have entered data for each piece of equipment in an option, you can view or print a one page report that summarizes all of the information. This page lists the name of each machine, the cost per scheduled machine hour and productive machine hour (both with and without labor) and the percent of machine costs that are fixed and variable.

To view the summary page, click the link near the option heading that says "View Summary of all Options". This will take you to a section of the worksheet that groups printer-friendly summaries of all five potential options.

To print the summary page, click that button that says "Print Summary for this Option. This will send the page directly to your printer. Alternatively, you can click the button to the right of the header that says "Print Summary of all Options" to print all five pages, if necessary.





PATH *Planning & Analysis in Timber Harvesting*

Venture Logging **Equipment Option 1** original

Summary of Hourly Costs for this Equipment Lineup

#	Machine Name	Costs with Labor $/SMH	Costs with Labor $/PMH	Fixed Costs	Variable Costs	Costs without Labor $/SMH	Costs without Labor $/PMH
1	Cable Skidder 1	$ 74.15	$ 84.26	29%	71%	$ 36.15	$ 41.08
2	Cable Skidder 2	$ 75.69	$ 86.01	31%	69%	$ 37.69	$ 42.83
3	Grapple Skidder 1	$ 66.44	$ 75.51	21%	79%	$ 28.44	$ 32.32
4	Grapple Skidder 2	$ 66.44	$ 75.51	21%	79%	$ 28.44	$ 32.32
5	Loader/Slasher	$ 66.44	$ 75.51	21%	79%	$ 28.44	$ 32.32
6	Bulldozer	$ 66.44	$ 75.51	21%	79%	$ 28.44	$ 32.32
7	Road Grader	$ 66.44	$ 75.51	21%	79%	$ 28.44	$ 32.32
8	Forwarder	$ 66.44	$ 75.51	21%	79%	$ 28.44	$ 32.32
9	Stroke Delimber	$ 66.44	$ 75.51	21%	79%	$ 28.44	$ 32.32
10	Loader/Slasher 2	$ 66.44	$ 75.51	21%	79%	$ 28.44	$ 32.32
11	Excavator	$ 66.44	$ 75.51	21%	79%	$ 28.44	$ 32.32
12	Front-end Loader	$ 66.44	$ 75.51	21%	79%	$ 28.44	$ 32.32
13	Pull-through delimb	$ 66.44	$ 75.51	21%	79%	$ 28.44	$ 32.32
14	Tractor w/rake	$ 66.44	$ 75.51	21%	79%	$ 28.44	$ 32.32
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

SMH = Schedule Machine Hour PMH = Productive Machine Hour

Fixed Costs include depreciations, insurance, interest and repairs and maintenance

Variable Costs include fuel, lubrication & labor

Summary of Detailed Equipment Costs

Trucking Options

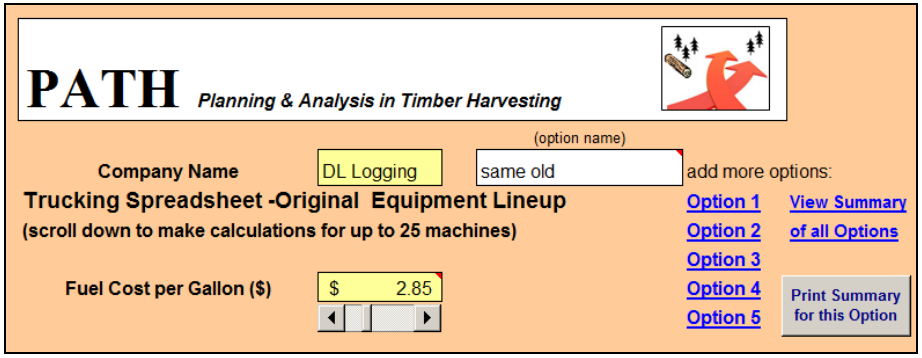
The Trucking Options worksheet (tab name Trucking) allows you to determine the hourly costs for each of your trucks. (up to 25). It also allows you to compare alternative trucking arrays (up to 5). Results are summarized in a printer friendly report and this information is used in other worksheets for further analysis.

It should be noted that if you do not own trucks as a part of your business, you can simply leave this worksheet blank.

The Trucking Options worksheet is very similar in design and format to the Equipment Options worksheet. For this reason, the background of this page is tan in color (instead of the gray used throughout the rest of PATH).

Upon entering the sheet, you are brought to the series of data entry boxes for your original trucks and prompted to name the option. A slide bar allows you to set and alter the fuel price for all of the trucks at the same time.

Each of the five trucking options has data entry sheets stacked atop one another in a series of columns. The option number (1, 2, 3, 4 or 5) runs continually down the length of the outside column.

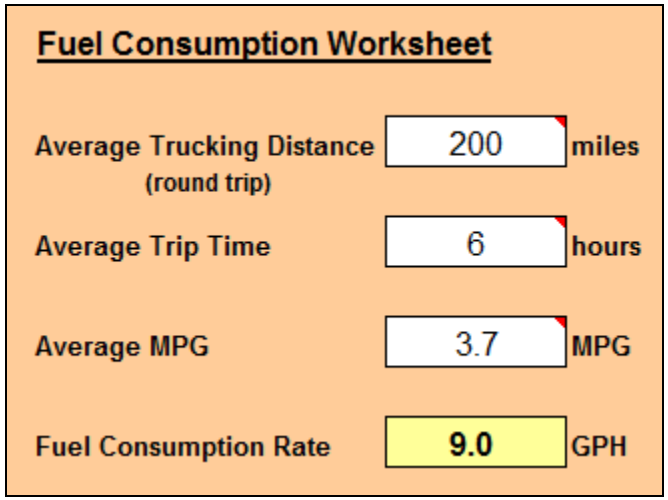


Trucking Costs Calculation Heading

Each truck is numbered and the user must supply a descriptive name. There are several white-cell inputs that must be filled in. These include acquisition cost, interest rate (or alternative rate of return for equipment purchased outright), as well as machine life and salvage value allow deprecation to be calculated. Insurance is another of the fixed costs that must be entered.

The scheduled hours per week and number of weeks per year are used in determining hourly costs. Fuel costs are supplied for all machines at once at the top of the page, as mentioned earlier.

The fuel consumption rate (gallons per hour) is determined using a small fuel consumption worksheet, where you supply the average trucking distance, trip time and miles per gallon.



Fuel Consumption Worksheet

Average Trucking Distance (round trip)	200	miles
Average Trip Time	6	hours
Average MPG	3.7	MPG
Fuel Consumption Rate	9.0	GPH

Individual Truck Fuel Consumption Worksheet

Annual repairs and maintenance costs are entered as a lump sum. Hourly labor costs and the utilization rate (% of scheduled time the machine is actually in operation) complete the inputs.

With these inputs in place, the cost per scheduled machine hour and cost per productive machine hour are calculated. These figures, in turn, are used in calculations by other worksheets.

Individual machine rate information is summarized in a white table to the right of the data input area. This information is shown for informational purposes, but not intended to be printed or altered. All of the pertinent information from this table is summarized and used elsewhere.

Summary Information Used in Calculations
(DO NOT ALTER THIS AREA)

Name:	DL Logging			
1,920.00	hours per year			
annual cost	$/SMH		$/PMH	
13,666.67	$ 7.12		$ 7.91	depreciation
3,291.67	$ 1.71		$ 1.90	interest
2,000.00	$ 1.04		$ 1.16	insurance
3,000.00	$ 1.56		$ 1.74	repairs & maintenance
64,022.40	$ 33.35		$ 37.05	fuel & lube
72,960.00	$ 38.00		$ 42.22	labor
158,940.73	$ 82.78		$ 91.98	
fixed	variable			
14%	86%			fixed/variable cost ratio

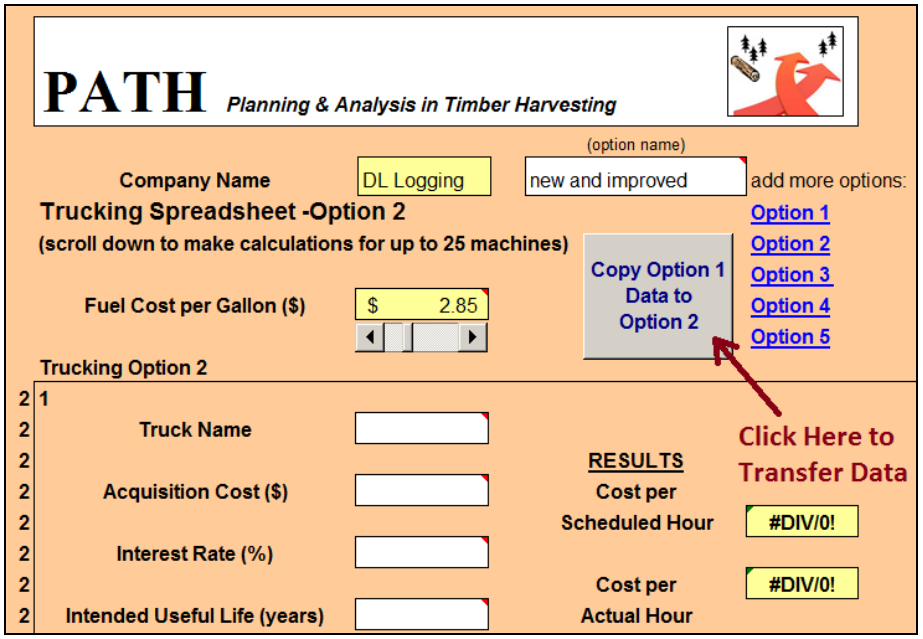
Trucking Rate Summary Information

Comparing Multiple Trucking Arrays

In addition to calculating the costs of owning and operating individual trucks and your truck fleet as a whole, PATH allows you to compare these costs to alternative truck fleets you may be considering. Five different collections of up to 25 trucks each can be compared.

Often the comparison you would like to make will involve slight alterations to your existing truck fleet. For example, you might be considering replacing two of your existing trucks with two new ones. To avoid entering the same data twice, PATH has a feature that allows you to copy all of the truck data from one option into the next one. You will then have to remove the data for the trucks you are considering replacing and add the data for the new equipment. You will also have to set the fuel cost for the new option.

The headings for Trucking Options two through five have a button that, when clicked, transfers all of the data from the previous option. Note that this cannot be easily undone. Undoing it can either be accomplished by exiting the file without saving your changes (something that in most cases will cause you to lose work that you might prefer to keep) or by manually deleting the data from each of the cells.



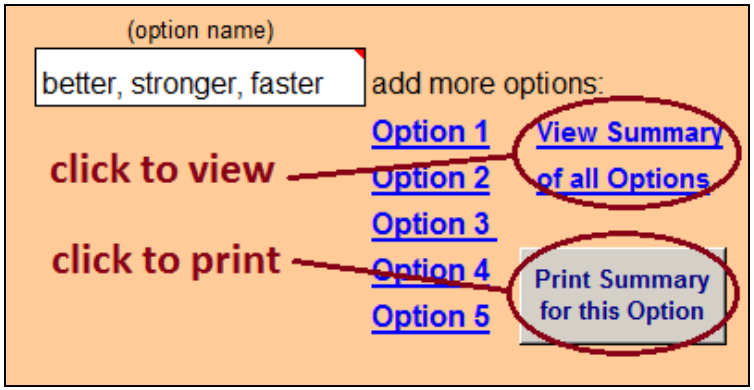
Data can be Copied from one Trucking Option to Another

Trucking Summary

After you have entered data for truck in an option, you can view or print a one page report that summarizes all of the information. This page lists the name of each truck, the cost per scheduled machine hour and productive machine hour, the percent of costs that are fixed and variable and fuel consumption rate (gallons/hour).

To view the summary page, click the link near the option heading that says "View Summary of all Options". This will take you to a section of the worksheet that groups printer-friendly summaries of all five potential options.

To print the summary page, click that button that says "Print Summary for this Option. This will send the page directly to your printer. Alternatively, you can click the button to the right of the header that says "Print Summary of all Options" to print all five pages, if necessary.



PATH *Planning & Analysis in Timber Harvesting*

DL Logging **Trucking Option 3** better, stronger, faster

Summary of Hourly Costs for this Trucking Lineup

#	Truck Name	Costs with Labor $/SMH	Costs with Labor $/PMH	Fixed Costs	Variable Costs	Fuel Consumption Gallons/Hour
1	Mack 1	$ 86.49	$ 96.10	19%	81%	9.01
2	Mack 2	$ 86.49	$ 96.10	20%	80%	9.01
3	Mack 3	$ 86.49	$ 96.10	15%	85%	9.01
4	Mack 4	$ 86.49	$ 96.10	18%	82%	9.01
5	Mack 5	$ 86.49	$ 96.10	18%	82%	9.01
6	Peterbuilt	$ 86.49	$ 96.10	19%	81%	9.01
7	Ford Dump 1	$ 86.49	$ 96.10	11%	89%	9.01
8	Ford Dump 2	$ 86.49	$ 96.10	7%	93%	9.01
9	Utility Truck	$ 86.49	$ 96.10	19%	81%	9.01
10	Small dump	$ 86.49	$ 96.10	13%	87%	9.01
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

SMH = Schedule Machine Hour PMH = Productive Machine Hour

Fixed Costs include depreciations, insurance, interest and repairs and maintenance

Variable Costs include fuel, lubrication & labor

Summary of Detailed Trucking Costs

Analyzing Equipment Alternatives

If you have entered a series of alternative combinations of equipment and trucks, PATH will prepare a detailed comparison of these options (up to five).

To get started click on the Equipment Comparison icon on the home page:

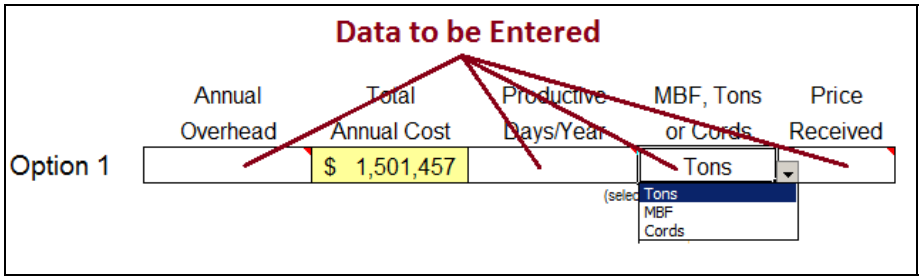
This will take you to a formatted, printer-friendly comparison two-page report. There are four pieces of information you must enter for each option to complete the report:

Annual Overhead – This includes all of the costs not accounted for by the equipment and trucking worksheets. You federal income tax return is a good place to find this information, though you may have to include estimated increases or decreases in annual overhead to go with each of the potential options.

Productive days per Year – This is the number of days you are set up on harvesting sites and producing, as opposed to the many additional days you work each year in support of the times when you produce.

MBF, Tons or Cords – Choose one of these three measures from the toggle-down choices in the box. If you create products that fall into more than one of these categories, use the Combining Production utility worksheet to combine all of your production into one measure.

Price Received – Enter the average price you receive for your products, corresponding to the measure you selected earlier (MBF, Tons or Cords).



Analyzing Equipment Alternatives (continued)

Once the annual overhead, productive days, product measure and price received have been entered, PATH makes several useful calculations.

The first calculation is the break-even level of production needed to justify the cost of each option, shown on a daily, weekly and annual basis:

Break Even Production Level Required for Each Option

	Annual	Weekly	Daily	
Option 1 same old set	247,595	6,038.9	1,207.8	Tons
Option 2 new & improved	296,436	7,410.9	1,482.2	Tons
Option 3 better, stronger, faster	231,407	5,933.5	1,186.7	Tons
Option 4 traditional	211,887	5,044.9	1,009.0	Tons
Option 5 post modern	274,631	6,241.6	1,248.3	Tons

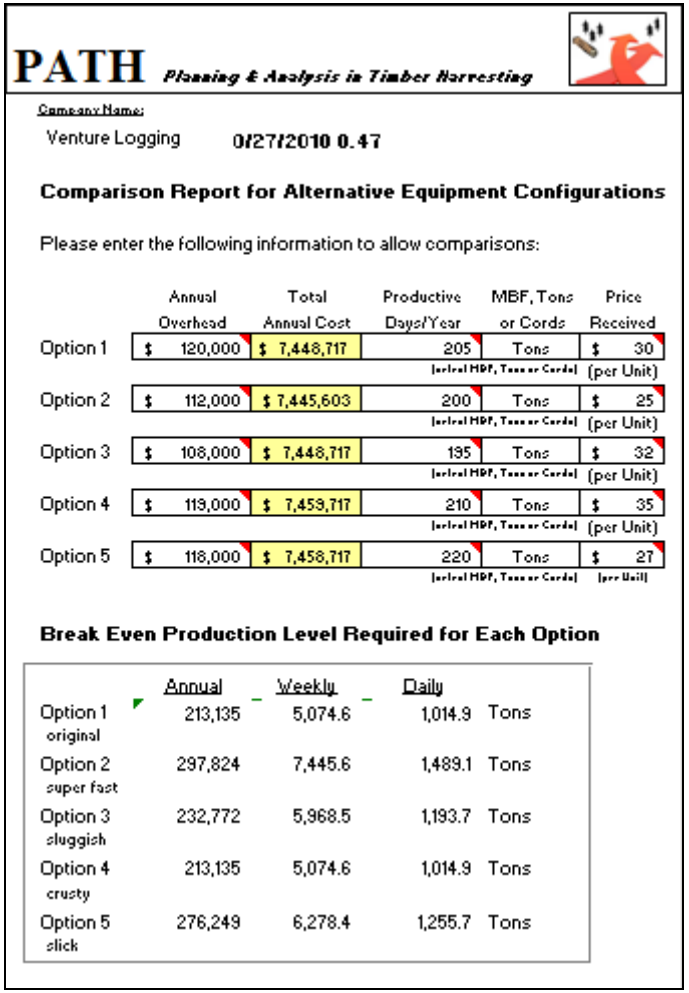
	Marginal Cost $/unit		
Option 1 same old set	$	24.48	ton
Option 2 new & improved	$	20.45	ton
Option 3 better, stronger, faster	$	26.23	ton
Option 4 traditional	$	28.64	ton
Option 5 post modern	$	22.10	ton

Marginal Costs of Production are Calculated both with and without Trucking

Analyzing Equipment Alternatives (continued)

The other calculation PATH makes with the information supplied is the marginal cost per unit of production. The marginal cost is the cost of producing each additional unit. Once you have produced enough to cover your annual expenses, the cost of each additional unit of production is equal to just the variable costs involved. You will keep producing as long as this price is lower than the price you are paid and as long as you don't run out of days in the year.

Only you can judge whether or not an option is viable. Take a close look at the production rates needed to justify the total annual expenses. Are these realistic levels of production? Does the amount you can expect to produce above the break-even level provide you with an acceptable level of profit for the risk and effort involved? If the answers to these questions are no, you can rule out an option.



PATH Planning & Analysis in Timber Harvesting

Company Name:
Venture Logging 0/27/2010 0.47

Comparison Report for Alternative Equipment Configurations

Please enter the following information to allow comparisons:

	Annual Overhead	Total Annual Cost	Productive Days/Year	MBF, Tons or Cords	Price Received
Option 1	$ 120,000	$ 7,448,717	205	Tons	$ 30 (per Unit)
Option 2	$ 112,000	$ 7,445,603	200	Tons	$ 25 (per Unit)
Option 3	$ 108,000	$ 7,448,717	195	Tons	$ 32 (per Unit)
Option 4	$ 119,000	$ 7,459,717	210	Tons	$ 35 (per Unit)
Option 5	$ 118,000	$ 7,458,717	220	Tons	$ 27

Break Even Production Level Required for Each Option

	Annual	Weekly	Daily	
Option 1 original	213,135	5,074.6	1,014.9	Tons
Option 2 super fast	297,824	7,445.6	1,489.1	Tons
Option 3 sluggish	232,772	5,968.5	1,193.7	Tons
Option 4 crusty	213,135	5,074.6	1,014.9	Tons
Option 5 slick	276,249	6,278.4	1,255.7	Tons

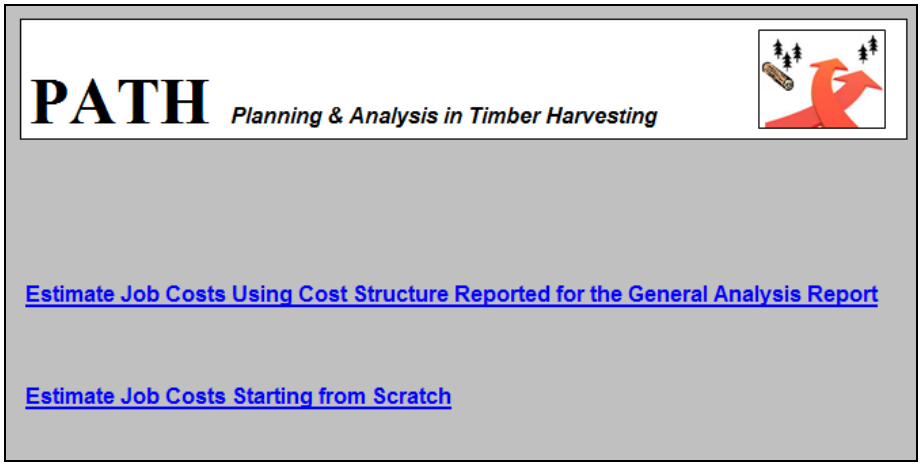
PATH Provides a Detailed Comparison Report

Estimating Individual Job Costs

PATH can be used to estimate the costs associated with individual harvesting jobs. You can either use some of the costs information you have already entered, or start from scratch with new information.

To get started, click on the Job Costs icon on the PATH home page:

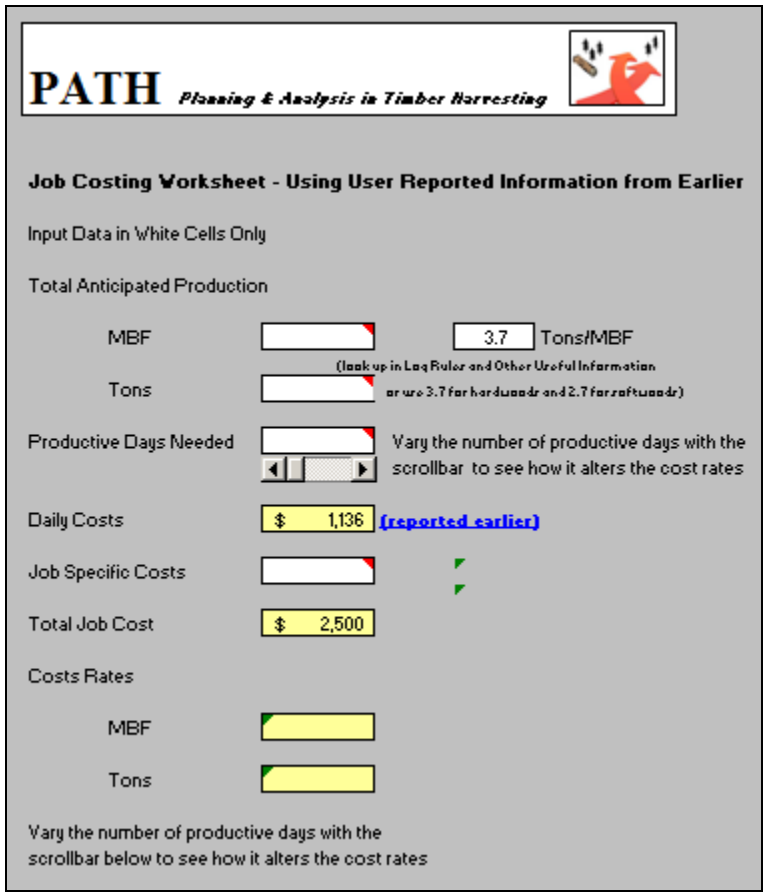
When you reach the Job Costs worksheet, you can choose which of the two options you would like to use:


PATH
Planning & Analysis in Timber Harvesting
Estimate Job Costs Using Cost Structure Reported for the General Analysis Report
Estimate Job Costs Starting from Scratch

These two links bring you to separate locations within this worksheet.

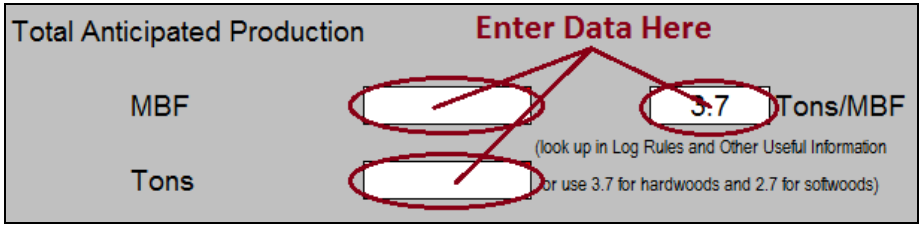
Estimating Individual Job Costs (continued)

If you choose the "Estimating Job Costs Using Costs Reported for the General Analysis Report" link, you are brought to a worksheet section that is built around the daily costs that were calculated from the information you supplied in the General Input worksheet. The estimator looks like this:

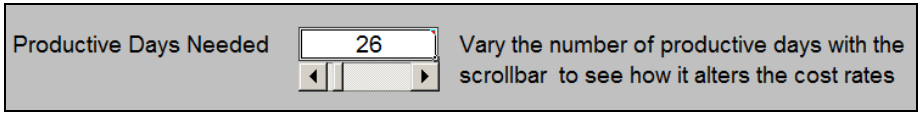

PATH
Planning & Analysis in Timber Harvesting
Job Costing Worksheet - Using User Reported Information from Earlier
Input Data in White Cells Only
Total Anticipated Production
MBF
3.7
Tons/MBF
(look up in Log Rules and Other Useful Information
Tons
or use 3.7 for hardwoods and 2.7 for softwoods)
Productive Days Needed
Vary the number of productive days with the scrollbar to see how it alters the cost rates
Daily Costs
$ 1,136
(reported earlier)
Job Specific Costs
Total Job Cost
$ 2,500
Costs Rates
MBF
Tons
Vary the number of productive days with the scrollbar below to see how it alters the cost rates

These calculations are built around the notion that, in the short run, all of your costs are fixed (in the long run, say a 6 months to a year, you can change your cost structure). With this in mind, it costs you nearly the same amount each day to operate, regardless of how much you produce.

To use this worksheet, you must supply the quantity of timber to be harvested, in MBF, tons or both. You also must enter a conversion factor (some suggestions are supplied) to allow PATH to put all of your production into like terms. Enter this information in these cells:

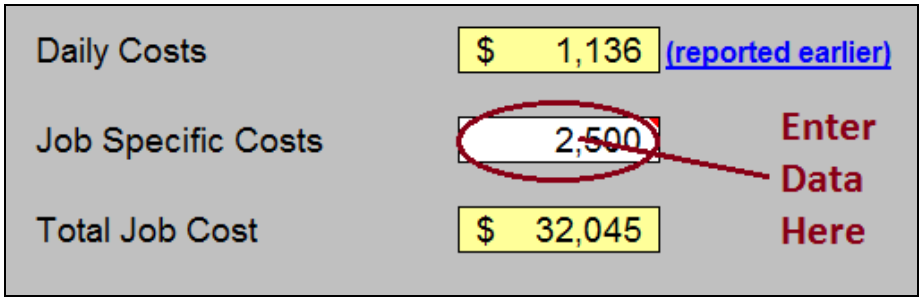


With this information in place, you must enter an estimate of the number of productive days needed to harvest this timber. It is important to be realistic in this estimate – being overly optimistic could prove to be costly. A slide-bar on this cell allows you to quickly vary this number and see how it changes your costs.

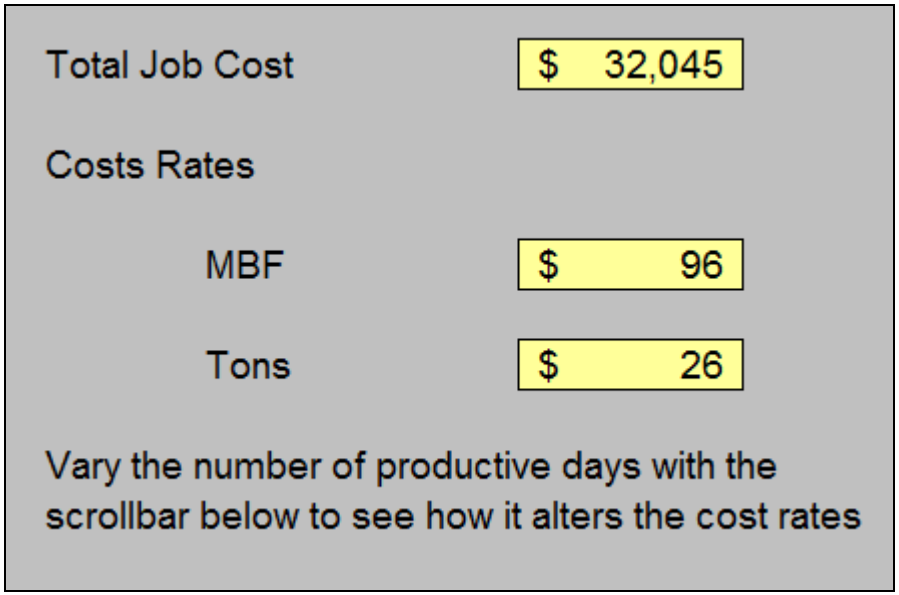


Estimating Individual Job Costs (continued)

With production levels, a conversion factor and an estimate of the number of productive days needed in place, the only thing that is left to enter is job specific costs. Job specific costs are those expenses incurred only for this particular job. Such costs include things like road construction, equipment rental, BMP costs, remedial work and so on. If you have to hire an outside trucker to move your equipment to this job site, that cost should be accounted for in this category.



With this final piece of information in place, PATH multiplies the average daily cost by the number of productive days needed for the job and then adds the job specific costs to arrive at total jobs costs. These total job costs are then divided by the anticipated production to arrive at the cost per MBF and/or cost per Ton for the job.



A note in PATH encourages you to vary the number of productive days with the scroll-bar to see how it alters the costs rates. This is an important part of your analysis, as it is difficult to predict the number of days needed for a job with certainty.

Bear in mind that your cost per unit of production is ***before*** profits. You should add an acceptable level of profit to negotiate a rate (or gauge an offer) for the job.

Estimating Individual Job Costs (continued)

What if the total production is higher or lower? As long as you have based your number of productive days on a realistic daily production rate, this cost structure will be accurate.

The other option in the Job Costs worksheet is to estimate jobs costs starting from scratch. It is accessed by clicking on the link of the same name at the Job Costs worksheet.

This option is very similar to the other Job Costs estimator, but one additional piece of information is required. You have to enter an estimate of your daily costs. The quickest method of doing this is to divide the total annual costs from your income tax return by your average number of productive working days each year.

As mentioned throughout this manual, productive working days are those spent on harvesting sites producing products (as opposed to the many additional days you work each year in support of this activity).

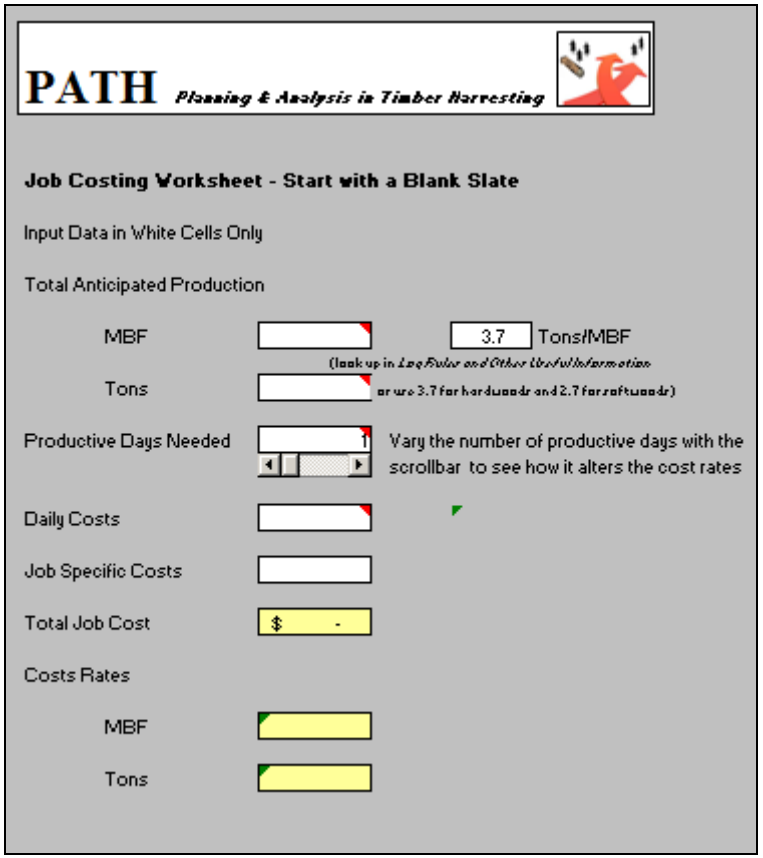
Income & Expenses Information Sources

	IRS Form	Income	Expenses
Proprietorship	1040, Sch C	Line 7	Lines 28+30
C Corporation	1120	Line 11	Line 27
Partnership	1065	Line 8	Line 21
S Corporation	1120S	Line 6	Line 20

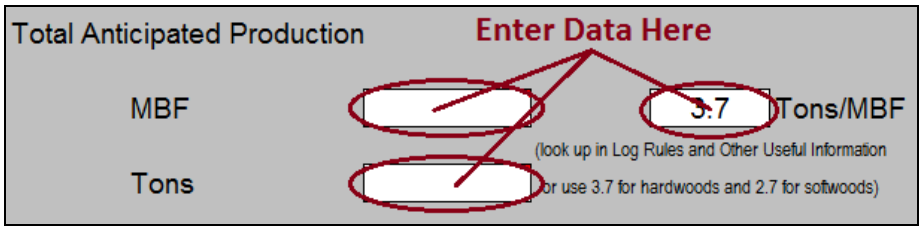
Expense Information can be found in Your Income Tax Return

Estimating Individual Job Costs (continued)

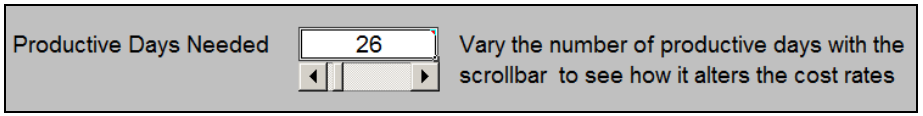
Once you have used your expense information and number of productive working days to determine your average daily expenses, calculation of individual job costs proceeds in much the same manner as was explained in the previous section. The estimator looks like this:



To use this worksheet, you must supply the quantity of timber to be harvested, in MBF, tons or both. You also must enter a conversion factor (some suggestions are supplied) to allow PATH to put all of your production into like terms. Enter this information in these cells:

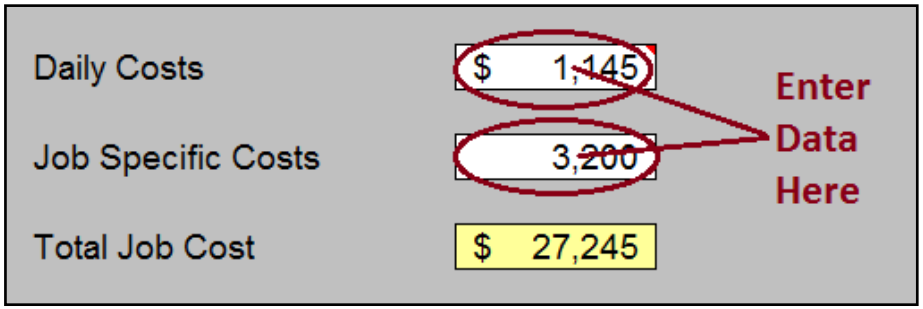


With this information in place, you must enter an estimate of the number of productive days needed to harvest this timber. It is important to be realistic in this estimate – being overly optimistic could prove to be costly. A slide-bar on this cell allows you to quickly vary this number and see how it changes your costs.

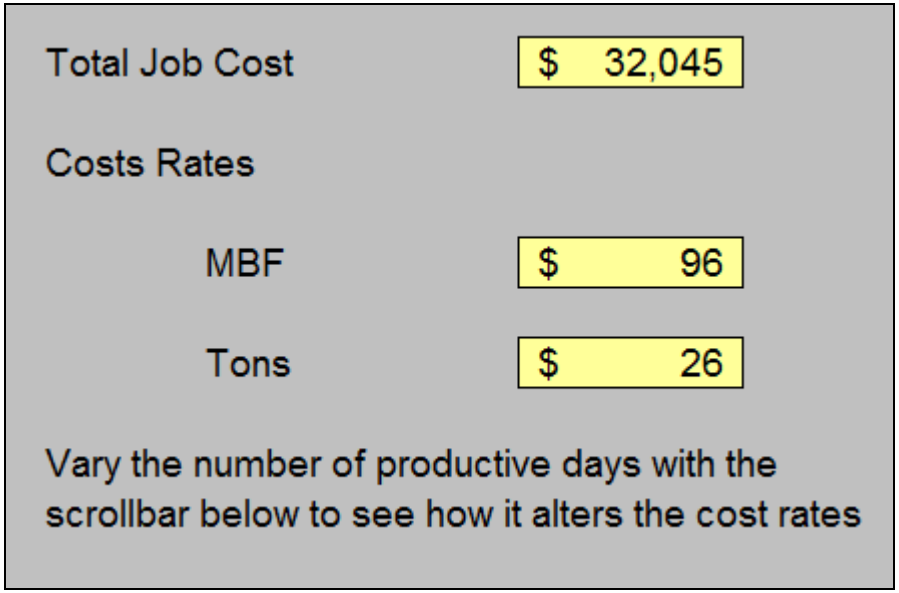


Estimating Individual Job Costs (continued)

With production levels, a conversion factor and an estimate of the number of productive days needed in place, the next items to be supplied are the daily costs (discussed earlier) and the job specific costs. Job specific costs are those expenses incurred only for this particular job. Such costs include things like road construction, equipment rental, BMP costs, remedial work and so on. If you have to hire an outside trucker to move your equipment to this job site, that cost should be accounted for in this category.



With these final pieces of information in place, PATH multiplies the average daily cost by the number of productive days needed for the job and then adds the job specific costs to arrive at total jobs costs. These total job costs are then divided by the anticipated production to arrive at the cost per MBF and/or cost per Ton for the job.



A note in PATH encourages you to vary the number of productive days with the scroll-bar to see how it alters the costs rates. This is an important part of your analysis, as it is difficult to predict the number of days needed for a job with certainty.

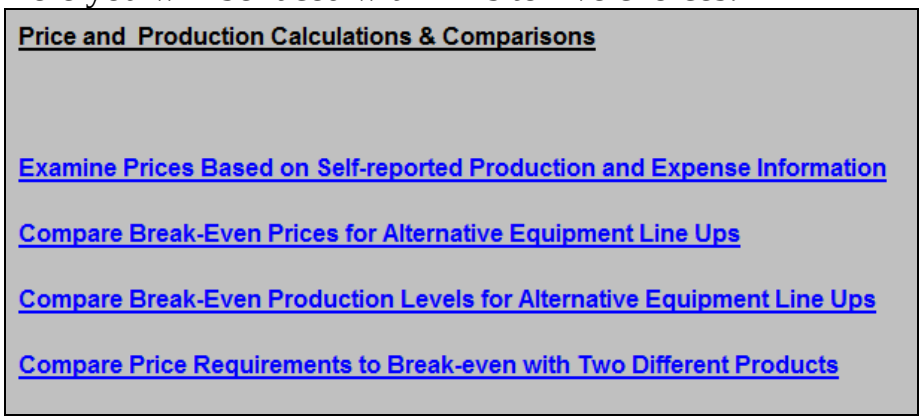
Bear in mind that your cost per unit of production is ***before*** profits. You should add an acceptable level of profit to negotiate a rate (or gauge an offer) for the job.

What if the total production is higher or lower? As long as you have based your number of productive days on a realistic daily production rate, this cost structure will be accurate.

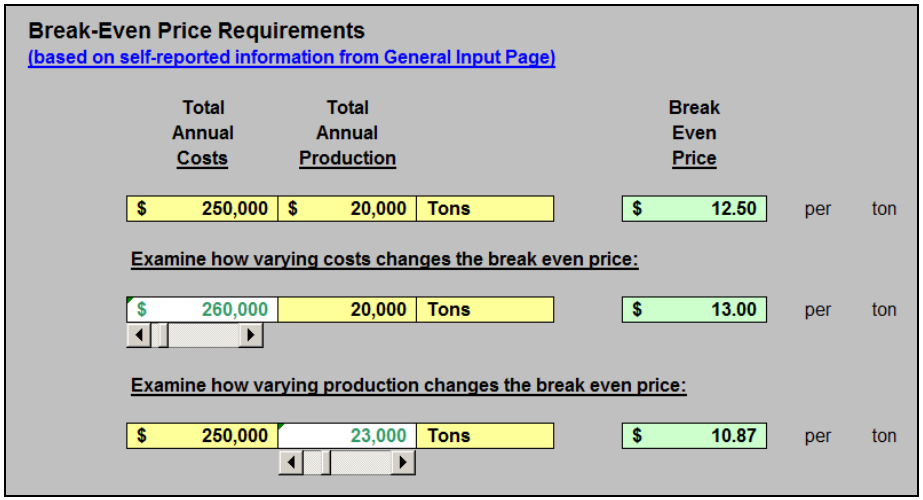
Price and Production Calculations & Comparisons

PATH allows you to make several different price and production calculations and comparisons. To view the choices in this worksheet, click on the Price Comparison icon on the PATH home page:

Here you will be faced with links to five choices:


Price and Production Calculations & Comparisons
Examine Prices Based on Self-reported Production and Expense Information
Compare Break-Even Prices for Alternative Equipment Line Ups
Compare Break-Even Production Levels for Alternative Equipment Line Ups
Compare Price Requirements to Break-even with Two Different Products

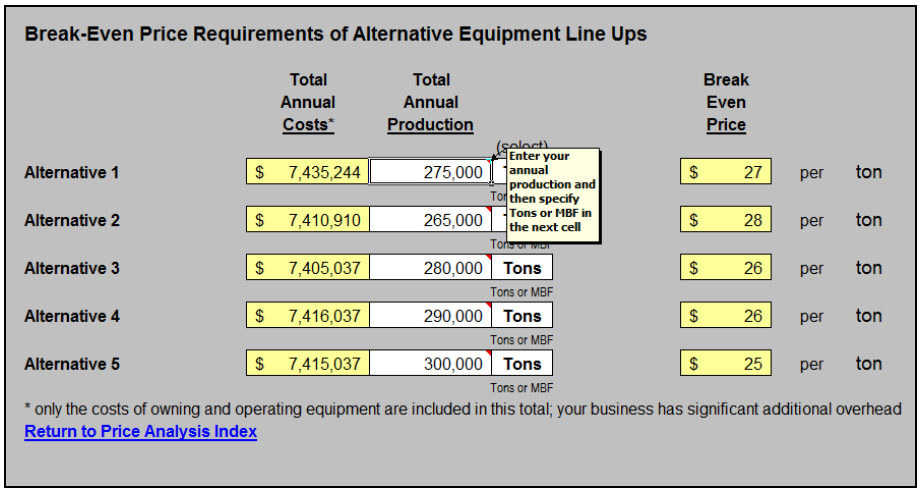
The ***Examine Prices Bases on Self-reported Production and Expense Information*** link brings up this sheet:



This sheet contains information supplied in the General Input worksheet. If you have not already supplied this information, you can go back to this sheet and enter it now. If the information has already been entered, this sheet calculates the break-even price per unit of production (MBF, tons or cords). Slide-bars allow you to alter both your total annual costs and your annual production to see how this changes the break-even price.

Price and Production Calculations & Comparisons (continued)

The *Compare Break-Even Prices for Alternative Equipment Line Ups* link brings up this sheet:



Break-Even Price Requirements of Alternative Equipment Line Ups

	Total Annual Costs*	Total Annual Production		Break Even Price		
Alternative 1	$ 7,435,244	275,000	(select) Tons or MBF	$ 27	per	ton
Alternative 2	$ 7,410,910	265,000	Tons or MBF	$ 28	per	ton
Alternative 3	$ 7,405,037	280,000	Tons	$ 26	per	ton
Alternative 4	$ 7,416,037	290,000	Tons	$ 26	per	ton
Alternative 5	$ 7,415,037	300,000	Tons	$ 25	per	ton

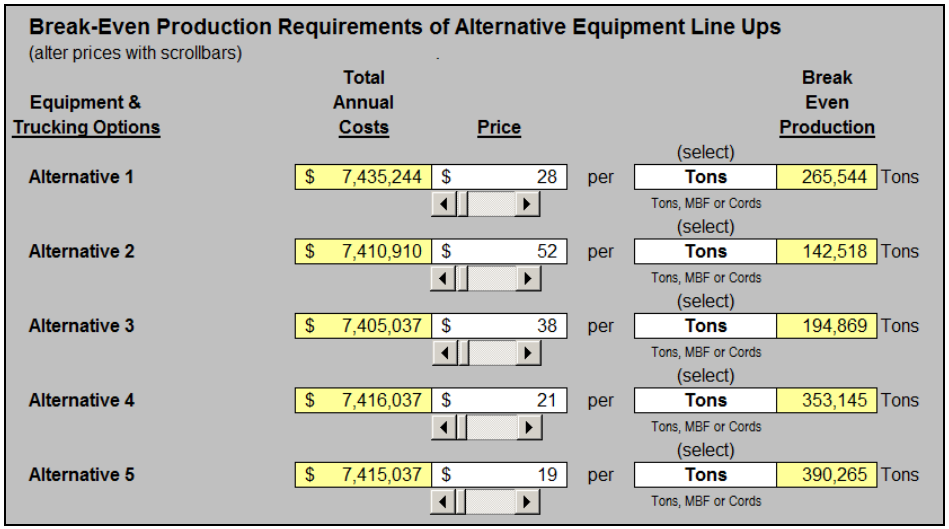
Enter your annual production and then specify Tons or MBF in the next cell

* only the costs of owning and operating equipment are included in this total; your business has significant additional overhead

Return to Price Analysis Index

This sheet transfers over the total annual cost estimates for up to five equipment and trucking alternatives from the Comparison of Equipment worksheet. If you entered annual overhead on that sheet it is included in this total. You must enter the anticipated total annual production for each option and select the product measurement (MBF, tons or cords) and PATH will calculate the break even prices in the column to the right.

The ***Compare Break-Even Production Levels for Alternative Equipment Line Ups*** link brings up this sheet:



Break-Even Production Requirements of Alternative Equipment Line Ups

(alter prices with scrollbars)

Equipment & Trucking Options	Total Annual Costs	Price			Break Even Production	
Alternative 1	$ 7,435,244	$ 28	per	(select) Tons (Tons, MBF or Cords)	265,544	Tons
Alternative 2	$ 7,410,910	$ 52	per	(select) Tons (Tons, MBF or Cords)	142,518	Tons
Alternative 3	$ 7,405,037	$ 38	per	(select) Tons (Tons, MBF or Cords)	194,869	Tons
Alternative 4	$ 7,416,037	$ 21	per	(select) Tons (Tons, MBF or Cords)	353,145	Tons
Alternative 5	$ 7,415,037	$ 19	per	(select) Tons (Tons, MBF or Cords)	390,265	Tons

As in the previous sheet, this sheet transfers over the annual cost estimates for up to five equipment and trucking alternatives from the Comparison of Equipment worksheet. Again, if you entered annual overhead on that sheet it is included in this total. Select the product measurement (MBF, tons or cords) and then set the price using the slide-bars for each option and PATH will calculate the break even levels of production in the column to the right. You can easily alter each price to see how this impacts the level of annual production needed to break even.

Price and Production Calculations & Comparisons (continued)

The ***Compare Price Requirements to Break-Even for Two Different Products*** link brings up this sheet:

Price Requirements to Break-Even with Two Dissimilar Products
(allows comparison of MBF & Ton, MBF & MBF and Ton & Ton prices)

Total Annual Expenses	500,000		
Product 1 Production	2,000	MBF	(select MBF or Tons)
Product 2 Production	9,000	Tons	(select MBF or Tons)
If Product 1 Price is:	180	per	MBF
Product 2 Price must be:	$ 16	per	ton
If Product 2 Price is:	24	per	ton
Product 1 Price must be:	$ 142	per	MBF

Return to Price Analysis Index

This sheet is unlike the others in that it does not import information from other worksheets. Instead it is more like a stand-alone utility. You must enter your annual expenses and the levels of production and units (MBF, tons or cords) for two products. Next you enter the price for the first product. PATH calculates the equivalent price for the second product. Alternatively, you may enter the price for the second product and PATH will calculate the equivalent price for the first product.

Amortization Utility

The Amortization Utility worksheet is not connected to other calculations in PATH. It is meant as a stand alone reference to help you in determining truck and equipment payments and making comparisons between loans.

This worksheet allows you to enter the principal, interest, and term for one or two loans. It then calculates the monthly payment and cumulative interest for the loan. If different sets of loan terms have been entered, it calculates the differences in payments and cumulative interest, two important considerations in selecting which loan is more favorable.

	Loan Option 1	Loan Option 2	Differences
Principal	$250,000	$250,000	**$0**
Annual interest	4.75%	4.25%	**0.50%**
Term (years)	10	10	**0**
Periods per year	12	12	
Start date	Sep-10	Sep-10	
Monthly Payment	$2,621.19	$2,560.94	**$60.26**
No. of Payments	120	120	**0**
Cumulative Interest	$ 64,543.23	$ 57,312.60	**$7,230.63**

Loan Amortization Input and Calculations

Suggested Rates

PATH contains a worksheet with a table of suggested rates for the useful life (years), salvage value (%), utilization rate (% of time) and repairs and maintenance rates (% of depreciation) for various types of logging equipment. This table was excerpted from *Machine Rates for Selected Forest Harvesting Machines* (Brinker, RW, et al. 2002. Circular 296, Auburn, AL: Alabama Agricultural Experiment Station. 29). This publication is a useful reference for any logger.

The Suggested Rates worksheet has a link on the PATH home page, along with sidebar index in each worksheet. You may find this reference particularly useful when you are entering data for individual machines in the Equipment Options worksheet.

Table 1. Machine Life, Salvage Value, Utilization, and Repair and Maintenance Estimators

Machine description	Life (years)	Salvage value[1]	Utilization[2]	Repair and maintenance[3]
Tree shear, without carrier	5	50	60	100
Fellerbuncher, sm., rubber tired	3	20	65	100
Fellerbuncher, med-lg., rubber tired	4	20	65	100
Fellerbuncher, lg., tracked, boom	5	15	60	75
Cable skidder, sm., <=80 hp	4	20	65	75
Cable skidder, med., 81-100 hp	4	20	65	90
Cable skidder, med., 101-120 hp	5	15	60	90
Cable skidder, lg., >=120 hp	5	10	60	90
Grapple skidder, 70-90 hp	4	20	65	90
Grapple skidder, >=91 hp	5	25	60	90
Grapple skidder, lg., tracked	5	15	65	100
Forwarder, shortwood	4	20	65	100
Slasher/loader, multi-stem	4	0	65	35
Delimber, iron gate	5	20	90	65
Harvester, combine	4	20	65	110
Loader, bigstick	5	10	65	90
Loader, sm., hydraulic	5	30	65	90
Loader, med., hydraulic	5	30	65	90
Chipper, sm.-med., 12"-18"	5	20	75	100
Chipper, lg., >=22"	5	20	75	100
Crawler tractor, <=100 hp	5	20	25	100
Crawler tractor, 101-200 hp	5	20	60	100
Crawler tractor, >=201	5	20	60	100

[1] Percent of purchase price.
[2] Percent of scheduled machine hours.
[3] Percent of annual depreciation.
Sources: Cubbage *(2),* Hypes and Stuart *(4),* Miyata (8), Warren *(13),* and authors.

Compiled from the above stated sources by Brinker, etal; presented in:
Brinker, R.W.; Kinard, J.; Rummer, B.; Lanford, B. 2002.
Machine rates for selected forest harvesting machines. Circular 296.
Auburn, AL: Alabama Agricultural Experiment Station. 29 p.

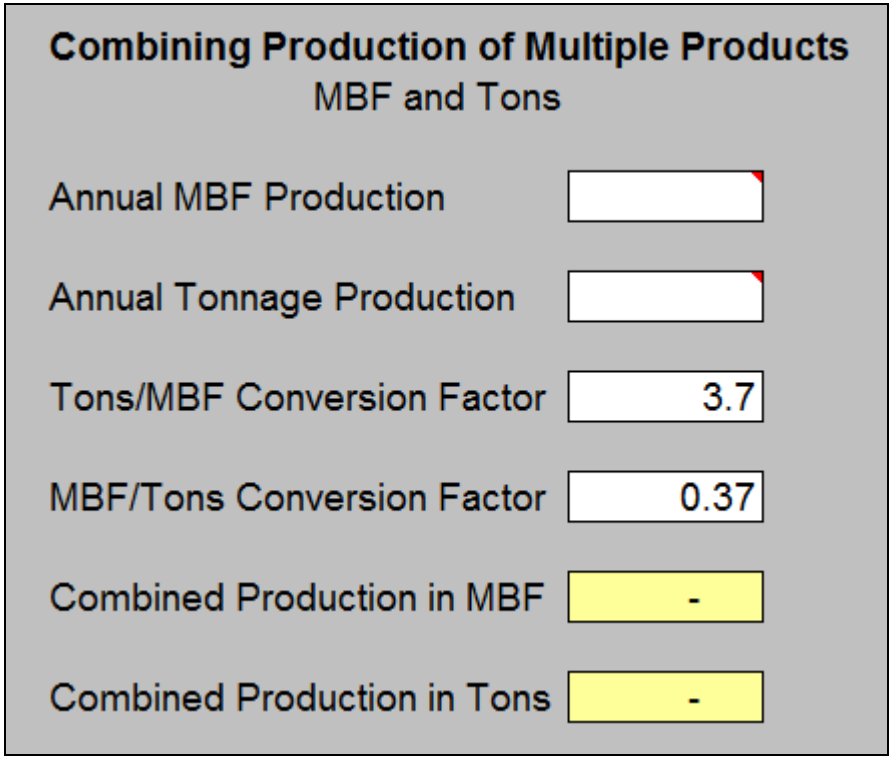
Suggested rates for Equipment Cost Calculations

Combining Production of Multiple Products

Loggers often produce multiple products that are measured in different ways. You might produce both sawlogs (measured in MBF) and pulpwood (measured in tons). This can make it difficult to analyze production. Combining different measures accurately is critical to making cost and production calculations in some of the PATH worksheets.

PATH includes a Combining Production of Multiple Products worksheet to make this calculation easier. The user supplies their production information for different products and then chooses the appropriate conversion factor to combine these into a single measure (MBF, tons or cords).

PATH supplies suggested conversion factors for both hardwoods and softwoods. It also allows the user to enter any factor that you know to be appropriate.



Combining MBF and Tons into either Measure

List of Formulas by Worksheet

General Input Worksheet

Profit = Income – Expenses

Cost per Unit = Expenses / Production

Cost per Day = Expenses / Productive Days

Average Price per Unit = Income / Production

Revenue per Day = Income / Productive Days

Production per Day = Production / Productive Days

Fixed Cost per Unit = Fixed costs / Production

Variable Cost per Unit = Cost per Unit – Fixed Cost per Unit

Average Daily Profit = Revenue per Day – Cost per Day

Analysis Report Worksheet

Daily Production Rates = daily production rates are shown ranging from 20% to 180% of average daily production

Individual Jobs Worksheet

Total Job Cost = (Daily Costs x Productive Days Needed) + Job Specific Costs

Cost Rates MBF = Total Job Cost / Total Production in MBF

Cost Rates Tons = Total Job Cost / Total Production in Tons

Price Analysis Worksheet

Break Even Price = Total Annual Costs / Total Annual Production

Break Even Production = Total annual Costs / Price per Unit

Product 2 Price = Total Annual Expenses – (Product 1 Production x Product 1 Price) / Product 2 Production

Product 1 Price = Total Annual Expenses – (Product 2 Production x Product 2 Price) / Product 1 Production

Equipment Worksheet

Cost per Scheduled Machine Hour = Total Annual Cost / # of Scheduled Hours

Cost per Productive Machine Hour = Cost per Scheduled Machine Hour / Utilization Rate

Trucking Worksheet

Cost per Scheduled Machine Hour = Total Annual Cost / # of Scheduled Hours

Cost per Productive Machine Hour = Cost per Scheduled Machine Hour / Utilization Rate

Fuel Consumption Rate = (Average Trucking Distance / Average MPG) / Average Trip Time

Comparison of Equipment Worksheet

Total Annual Cost = Annual Overhead + Total Equipment Costs for this Option + Total Trucking Costs for this Option

Annual Break Even Production Level = Total Annual Cost / Price per Unit

Weekly Break Even Production Level = Annual Break Even Production Level / (Productive Days per Year / 5)

Daily Break Even Production Level = Annual Break Even Production Level / Productive Days per Year

Marginal Cost = Variable Annual Costs of Equipment and Trucks / Annual Break Even Production Level

Amortization Worksheet

Payment (Excel formula) = PMT(rate, number of periods, present value)

Number of Payments = Terms (years) x Periods per Year

Cumulative Interest = (Payment x Number of Payments) - Principal

Differences – Loan Option 1 – Loan Option 2

Combining Production Worksheet

MBF and Tons

Combined Production in MBF = Annual MBF Production + (Annual Tonnage Production x MBF per Ton Conversion Factor)

Combined Production in Tons = Annual Tons Production + (Annual MBF Production x Tons per MBF Conversion Factor)

MBF and Cords

Combined Production in MBF = Annual MBF Production + (Annual Cordwood Production x MBF per Cord Conversion Factor)

Combined Production in Cords = Annual Cordwood Production + (Annual MBF Production x Cords per MBF Conversion Factor)

Steven Bick is a natural resource management consultant with Northeast Forests, LLC. He is the author of six books on forestry and conservation and has designed and taught continuing education programs for landowners, loggers and foresters since 1994. An adjunct professor in the Department of Forest and Natural Resources Management at SUNY College of Environmental Science and Forestry, Steve is also an SAF Certified Forester. He can be reached at steve@northeastforests.com.